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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/789,781	02/27/2004	Sheldon Shafer	GEPL.P-093	9454
43247	7590	09/07/2005	EXAMINER	
OPPEDAHL & LARSON LLP - LEXAN PO BOX 5068 DILLON, CO 80435			BOYKIN, TERRESSA M	
			ART UNIT	PAPER NUMBER
			1711	
DATE MAILED: 09/07/2005				

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/789,781

Applicant(s)

SHAHER ET AL.

Examiner

Terressa M. Boykin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 15 July 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-49 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-49 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 February 2004 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 7-15-05.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**35 USC 103**

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 1-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Schissel (USP 4831105) see cols.1-3; or Riding (USP 5102975 ) see cols. 1-2; each separately in view of USPub 2003/0208027 see abstract, claims.**

**USP 5102975** discloses a polycarbonates are provided exhibiting anisotropic properties in the melt. The reference discloses tow diol components as claimed wherein the transesterification of diphenyl carbonate is effected in the melt with a mixture of 4,4'-dihydroxybiphenyl and 4,4'-dihydroxyphenylether. The polymer readily forms high strength fibers from the melt.

The reference particularly refers to liquid crystalline polycarbonates derived from diphenyl carbonate, 4,4'-dihydroxybiphenyl and 4,4'-dihydroxyphenylether.

The reference involves liquid crystalline polycarbonates which are capable of forming an anisotropic melt and which are the reaction products of 4,4'-dihydroxybiphenyl and 4,4'-dihydroxyphenylether and diphenyl carbonate. The polymers exhibited liquid crystallinity at approximately 350.degree. C. and above, readily formed high strength fibers from the melt and were insoluble in solvents such as dichloromethane. The reference involves aromatic polycarbonates which exhibit liquid crystalline properties

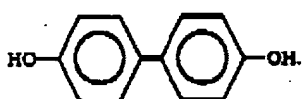
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and which are prepared by reacting a mixture of 4,4'-dihydroxybiphenyl and 4,4'-dihydroxyphenylether with diphenylcarbonate via a melt process.

The 4,4'-dihydroxyphenylether can be represented by the formula:



The diphenyl carbonate can be represented by the formula:



The polycarbonate is made by melting a mixture of 4,4'-dihydroxybiphenyl, 4,4'-dihydroxyphenylether and diphenyl carbonate under an inert, nonoxidizing atmosphere such as a nitrogen atmosphere, at a temperature range of from 200.degree. C. to 380.degree. C. The mixture can be agitated to effect the removal of phenol during the transesterification reaction. The diphenylcarbonate can be employed at a level of from 50 mole percent to 55 mole percent based on the total moles of 4,4'-dihydroxybiphenyl, 4,4'-dihydroxyphenylether and diphenyl carbonate. During transesterification, a vacuum can be used in combination with agitation, such as achieved with the use of an extruder reactor, or stirrer to facilitate the removal of phenol.

The 4,4'-dihydroxybiphenyl is preferably present at a level of from about 50 mole percent to about 80 mole percent based on the total moles of 4,4'-dihydroxybiphenyl and 4,4'-dihydroxyphenylether reacted to form the polycarbonate, more preferably the 4,4'-dihydroxybiphenyl is present at a level of from 60 mole percent to 75 mole percent and most preferably is present at a level of 70 mole percent thereof, and the 4,4'-dihydroxyphenylether is preferably present at a level of from about 20 mole percent to 50 mole percent based on the total moles of 4,4'-dihydroxybiphenyl and 4,4'-

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dihydroxyphenylether reacted, more preferably at a level of from 25 mole percent to 40 mole percent and most preferably at a level of about 30 mole percent thereof.

See claims 1, 5, 6, 7, 8, 9.

**US 4831105** discloses polycarbonates exhibiting anisotropic properties in the melt. Specifically, the polycarbonates exhibit liquid crystalline properties, which are prepared by effecting in the melt, the transesterification of diphenylcarbonate with a mixture of methylhydroquinone and 4,4'-dihydroxybiphenyl are found to be insoluble in several common solvents such as chloroform, methylenechloride, and toluene.

The reference discovered that polycarbonate exhibiting liquid crystalline properties at temperatures exceeding 300.degree. C., can be prepared in the melt by a transesterification reaction between diphenylcarbonate and mixtures of methylhydroquinone and 4,4'-dihydroxybiphenyl. The polycarbonates are found to be insoluble in common solvents, such as chloroform, methylene chloride, toluene, orthodichlorobenzene and 1,1,2,2-tetrachloroethane.

The reference discloses a composition wherein 25-60 mole % of the bis(phenylenecarbonate) units and about 75-40 mole % of the methylphenylenecarbonate units based on the total moles of intercondensed carbonate units of the polycarbonate.

The reference also a method for making a polycarbonate capable of forming an anisotropic melt which comprises, effecting the removal of phenol from a molten mixture, while it is agitated, consisting essentially of 4,4'-dihydroxybiphenyl, methylhydroquinone, and diphenylcarbonate.

In the practice of the invention, a mixture of 4,4'-dihydroxybiphenyl, methylhydroquinone and diphenylcarbonate can be melted under an inert, nonoxidizing atmosphere such as a nitrogen atmosphere, at a temperature in the range of from

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about 300.degree. C. to 360.degree. C. The mixture can be agitated to effect the removal of phenol during the transesterification reaction. There can be utilized 50 to 55 mole % of diphenylcarbonate based on the total moles of 4,4'-dihydroxybiphenyl, methylhydroquinone and diphenylcarbonate. During the transesterification, a vacuum can be used in combination with agitation, such as achieved with the use of an extruder reactor, or stirrer to facilitate the removal of phenol.

A mixture of 3.80 grams (0.0298 mole) of methylhydroquinone, 2.36 grams (0.0127 mole) of 4,4'-dihydroxybiphenyl, and 10.0 grams (0.0468 mole) of diphenylcarbonate was melted under a nitrogen atmosphere while the mixture was stirred. A small amount of phenol was collected, and the temperature of the melt was raised to 320.degree. C. over a period of one hour along with the use of a vacuum of approximately 1 torr which was applied for an additional hour while the mixture was stirred. During this period, the distillation rate of phenol increased to a maximum before decreasing and eventually stopping. The stirring of the mixture also became increasingly difficult as the viscosity of the reaction mixture increased. There was obtained a very fibrous semi-molten mass of polymeric product which quickly solidified upon cooling. Based on method of preparation, the product was a polycarbonate consisting essentially of biphenylcarbonate units intercondensed with methylhydroquinone carbonate units. The material was isolated, ground into a fine powder, and analyzed by differential scanning calorimetric and polarized light microscopy.

When examined microscopically between crossed polarizers, the 70/30 polymer displayed a birefringent, anisotropic, liquid crystalline phase between 245.degree. C. and 305.degree. C. The 60/40 composition became birefringent when pressure was applied to a cover glass over a sample of the copolymer at temperatures above 300.degree. C. In addition, the 50/50 copolymer and 40/60 copolymer developed areas of birefringency when the melt was held at 350.degree. C. Based upon the above

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results, one skilled in the art would know that liquid crystalline polycarbonates are provided exhibiting valuable anisotropic properties, particularly when the copolymer contains about 60-70 mole % of methylhydroquinone carbonate units and about 30-40 mole % of diphenylcarbonate units.

The reference clearly points out that although the above example is directed to only a few of the very many variables which can be used in making the liquid crystalline polycarbonate compositions of the reference, it should be understood that the reference is directed to *a much broader variety of liquid crystalline polycarbonates* as shown in the description preceding the example therein. Note Table, and claim 1.

Thus, the references above discloses a liquid crystal polymer specifically a polycarbonate prepared from the same components as claimed by applicants except for the particular activated carbonate as claimed. Note, however, that **USPub 20030208027** discloses a method for preparing a polycarbonate comprises preparing a free hydroxyl-containing polycarbonate and reacting the hydroxyl containing polycarbonate with a mixture of (B) a symmetrical optionally activated aromatic carbonic acid diester and (C) an optionally substituted aromatic dihydroxy compound, diol or diacid. A copolymerization reagent comprises a mixture of (B) a symmetrical optionally activated aromatic carbonic acid diester and (C) an optionally substituted aromatic dihydroxy compound, diol or diacid. A copolymer comprises [polycarbonate] x moieties; (B) [symmetrical optionally activated aromatic carbonic acid diester].y moieties and (C) [optionally substituted aromatic dihydroxy compound, diol or diacid]z moieties, wherein x, y and z are mole percents of the

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copolymer. The reference specifically discloses the use of bis-(methyl salicyl) carbonate. The reference also employs a transesterification catalyst is a quaternary ammonium compound or a quaternary phosphonium compound. Non-limiting examples of these compounds include tetramethyl ammonium hydroxide, tetramethyl ammonium acetate, tetramethyl ammonium fluoride, tetramethyl ammonium tetraphenyl borate, tetraphenyl phosphonium fluoride, tetraphenyl phosphonium tetraphenyl borate, tetrabutyl phosphonium hydroxide, tetrabutyl phosphonium acetate, and dimethyl diphenyl ammonium hydroxide. It would have been obvious to one having ordinary skill in the art at the time the invention was made to employ the specific activated diphenyl carbonate of **USPub 20030208027** as the diphenyl carbonate source in either of the reference above since the **USPub 20030208027** discloses that such use of the activated carbonate accords improved process condition in a continuous melt reaction system as well as improved processing reagents. Further, the use of the catalyst is well known in the art and is of no patentable merit in a melt transesterification process.

Consequently, since applicant's claims contain process steps which are exhaustively well-known in the art and would be a matter of design choice, i.e. choosing a diphenyl carbonate, the claimed invention cannot be deemed as unobviousness and accordingly is unpatentable.



**Correspondence**

**Please note that the cited U.S. patents and patent application publications are available for download via the Office's PAIR. As an alternate source, all U.S. patents and patent application publications are available on the USPTO web site ([www.uspto.gov](http://www.uspto.gov)), from the Office of Public Records and from commercial sources. Applicants may be referred to the Electronic Business Center (EBC) at <http://www.uspto.gov/ebc/index.html> or 1-866-217-9197.**

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Terressa Boykin whose telephone number is 571 272-1069. The examiner can normally be reached on Monday through Friday from 6:30am to 3:00pm.

The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. The general information number for listings of personnel is ( 571-272-1700).

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

tmb

  
Examiner Terressa Boykin

TERRESSA M. BOYKIN  
PRIMARY EXAMINER